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REVIEW ON RESEARCH, EXPLOITATION AND MANAGEMENT OF THE STOCKS OF SEA TURTLES

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INTRODUCTION

The Caribbean region contains many important sea-turtle nesting colonies. Those of Dermochelys in French Guiana, Chelonia mydas in Costa Rica and Lepidochelys kempi in the Gulf of Mexico are some of the largest known nesting aggregations of these species anywhere in the world. Apart from this, almost every mainland or island sand beach has some nesting turtles. A large amount of important biological research has been conducted in the region, particularly regarding nesting behaviour, migrations, and population dynamics of sea turtles; but in most areas conservation programmes are still in their infancy. Exploitation and management patterns have been tailored normally to suit the economic and social conditions of the country concerned but it is questionable whether such restricted planning is acceptable today. When the serious world decline in turtle populations and the wide ranging, migratory habits of these animals is taken into account, it is apparent that the conservation policy of one country may affect turtle stocks, not only in a neighbouring country but in the whole western Atlantic area. The development of effective national programmes depends on the formulation of a coordinated regional research and management plan aimed at the resuscitation and wise utilization of the depleted turtle stocks of the Caribbean region.

In the CICAR[1/] programme sea turtles are the concern of the Working Group on Fisheries Resources. The Assistant International Coordinator for Fisheries, in his report to the Fifth ICG Meeting of CICAR in Havana in 1972, proposed that a group of turtle specialists develop a regional research and management programme for sea turtles. He suggested further that a summary was required of the existing knowledge of turtle stocks and the present state of exploitation.

The report that follows is an assessment of the current knowledge of turtle stocks, their exploitation and management in the Caribbean region. It is a revision of a paper presented for discussion at the Sixth ICG Meeting of CICAR in Cartagena, Colombia, in July 1973.

SUMMARIES OF NATIONAL PROGRAMMES

In this section a brief statement is made of the estimated size of the sea-turtle nesting populations in each CICAR country. Special emphasis is placed on the turtle protection laws and methods of enforcement, the degree of exploitation of the resource, and, where appropriate, details of active or proposed management programmes. Biological studies on turtles carried out in the region are not reported.

The member countries situated in the western Atlantic are treated alphabetically for convenience. The region extends from Brazil in the south, through Central America and the Caribbean islands, to the U.S.A. in the north. For Colombia, Mexico and other countries which have nesting beaches on the Pacific seaboard also, data are given only for the Caribbean, Gulf of Mexico and Atlantic coasts.

The information on which this report is based was obtained from the published literature listed, from discussions with fisheries officers and turtle specialists in several CICAR countries held during 1972 and 1973, and from correspondence with turtle biologists working in the region. The help given by these persons is acknowledged below.

Six species of sea turtles are known from the Caribbean and adjacent regions. These are listed as follows, together with the common names used in this report. The taxonomic problem of possible sub-specific distinction from Pacific forms is not considered here.

1/ Cooperative Investigation of the Caribbean and Adjacent Regions

Species	Common names used
Caretta caretta (L.)	Loggerhead
Chelonia mydas (L.)	Green
Dermochelys coriacea (L.)	Leatherback
Eretmochelys imbricata (L.)	Hawksbill
Lepidochelys kempi (Garman)	Kemp's Ridley
L. olivacea (Esch.)	Olive Ridley

Brazil

No survey of nesting beaches or feeding grounds of turtles on the Brazilian coast has been carried out. Green turtles and Olive Ridleys, tagged while nesting in Surinam, have been caught at sea off Brazil on numerous occasions. Turtles nesting in Ascension Island also feed on the coast of Brazil off the states of Ceara, Rio Grande do Norte, Pernambuco, and Bahia and around Vitoria.

Lepidochelys olivacea has been recorded nesting from Natal and some leatherback nesting is also reported.

No information on management regulations or practices was obtained and the most recent exploitation data available were from the FAO Fisheries Yearbook of 100 metric tons for 1968.

British Territories

(The territories included here are British Honduras[1/], The British Virgin Islands - Tortola and Anegada, Cayman Islands, Barbuda, Bahamas Islands[1/], Antigua, St. Kitts, Nevis, Dominica, St. Lucia, St. Vincent, Grenada[1/], Anguilla and Montserrat.)

Information from British Honduras and the British islands is sparse. Scattered nesting records were available for some areas but details of protective legislation and exploitation rates were not.

Stocks

Leatherback nesting occurs on St. Kitts, Nevis, Grenada, St. Vincent, Barbados, Tortola and the Bahamas Islands. Green turtles are recorded from most islands and British Honduras although the numbers nesting and the nesting beaches are not fully documented. Eretmochelys nests in Grenada, Dominica, Montserrat, the Cayman Islands and among the cays off British Honduras. Caretta is the commonest turtle in British Honduras.

Management

Turtle boats from St. Lucia, Dominica and certain other islands regularly fish the Aves Islands nesting aggregation. St. Lucia has a turtle closed season from 1 June to 31 August but some companies have concessions to import turtles at this time. These are bought by an American company and exported live to Puerto Rico. Grenada has a closed season from June to September.

The Cayman Islands have legislation to protect nesting turtles, details of which were not available, but at the present time all the wild harvested green turtles exported come from foreign waters.

1/ Now independent

In the Virgin Islands there is an industry based on Dermochelys trunk oil from netted leatherbacks and this is used for medicinal purposes.

Two turtle farms have been established in the British islands. An early one on Great Inagua Island, Bahamas, was a pilot turtle ranch administered for the Caribbean Conservation Corporation. In this ranch hatchling turtles of various species were reared in an area of turtle grass pasture which had been enclosed. The hatchlings grew up to 3.6 kg in two years on a conch diet.

The second, more extensive farm, is the "mariculture" entreprise on Grand Cayman Island This was set up in 1968 as a private company to rear turtles. Approximately 150 000 green turtles of various ages are kept on two areas in concrete and fibreglass tanks built on land with circulating sea water. The farms were originally stocked from eggs and hatchlings taken in the wild in Ascension Island, Surinam and French Guiana, but it is hoped that the farm will soon produce its own juveniles in sufficient quantity to remove the dependence on wild stocks. Females, which are gravid when captured, readily lay eggs on the artificial beaches and, in 1973, animals which had mated in the ponds nested successfully for the first time. The farm has already started to sell quantities of high-quality turtle products on the world market. These include meat, calipee, hides, shell, oil and stuffed yearling turtles. The turtles are killed when they are three years old and weigh about 45 kg. Mariculture is slaughtering some 15 000 each year.

Colombia

Stocks

On the Caribbean coast of Colombia sea turtles are known to nest east of Santa Marta on a 60-km stretch of beach between the Rio Don Diego and the Rio Buritaca. This is probably the most important nesting beach for the loggerhead (Caretta caretta) in the Caribbean with a population estimated at 400-600 females.

Chelonia mydas and Eretmochelys imbricata nest only occasionally and Dermochelys is rare. It is possible that Lepidochelys olivacea nests also, although no details are available.

Nesting probably occurs near Cartagena since turtles and eggs are sold in the town's markets.

Management

From 1970 the beaches east of Santa Marta have been effectively patrolled by beach guards of the Government institution INDERENA (Instituto del Desarrollo de Recursos Naturales Renovables). Control of exploitation has been affected through inspectors and fines. Apart from this, no legislation exists for the protection of sea turtles in Colombia, although INDERENA is expected to propose conservation legislation which includes the establishment of the Don Diego-Buritaca loggerhead beach as a sanctuary area.

There are no statistics available for the annual catch of turtles and eggs in Caribbean Colombia except that 500-600 turtles pass through Cartagena markets.

Albuquerque Cays

Loggerheads and hawksbills nest on the cays. About 30-40 turtles are taken each year.

La Providencia Island

Caretta is the commonest species and some nesting occurs.

Costa Rica

Stocks

There is an important leatherback beach at Matina where at least 1 000 females nest. The beach at Tortuguero, well known as the site of nesting behaviour and migration studies, supports the major Caribbean nesting aggregation of Chelonia mydas with about 6 000 females nesting annually. Green turtles come to nest on Tortuguero from feeding grounds in several countries, including Panama, Nicaragua, Florida, Colombia, Mexico and Venezuela. A few hawksbill turtles nest on Tortuguero as does the loggerhead occasionally.

Management

Measures have been introduced by the Government of Costa Rica to protect the Tortuguero nesting colony. These include prohibiting harpoon boats from working within one mile of the shore, a regulation which is enforced by the coastguard and supported financially by the Caribbean Conservation Corporation. The Corporation has built camps on the middle section of the beach from which patrols are made by Government workers and military personnel during the nesting season. The Government is expected to establish the Tortuguero National Park in the near future which includes most of the main nesting area and this will be protected by park wardens.

A project supported by the Caribbean Conservation Corporation was started at Tortuguero to rear hatchlings and transport these to other Caribbean beaches which no longer had nesting turtles. This project was terminated after nine years since there was no reliable evidence that it was being successful in restocking depleted nesting grounds.

Costa Rica is the custodian for the west Caribbean nesting ground of Chelonia mydas but is without a resident population which could be exploited outside the breeding season. If this country undertook expensive conservation measures, as it was being pressured to do by a number of conservation agencies, the benefits would be reaped largely by neighbouring countries, such as Nicaragua, which has the largest feeding grounds for this species in the region. Consequently, representatives of the Government of Costa Rica, Nicaragua and Panama met in San Jose, Costa Rica in 1968 to draw up a tripartite agreement on green-turtle exploitation. This meeting was supported by FAO, CCC and other interested bodies. It was agreed to:

> "prohibit entirely the catching of green turtles or the taking of their eggs for commercial and/or industrial use for a temporary three-year period, during which a study would be made of the feasibility of setting up permanent regulatory machinery ensuring the conservation of these resources by sound management practices on an international level and to invite other Caribbean governments to join in this agreement."

Costa Rica and Panama have ratified the agreement but Nicaragua's ratification is still lacking. The recent earthquake in Nicaragua has inevitably delayed the signing of this agreement and so far no other country has shown itself interested in joining. Because of this, the agreement, with its three-year ban on turtle exploitation, has never come into force. Meanwhile there is a lack of turtle fishery statistics for Costa Rica.

Cuba

Stocks

Three species are considered important to the Cuban turtle fishery. These are: Chelonia mydas, Caretta caretta and Eretmochelys imbricata which nest on beaches all round the island. Dermochelys is caught occasionally at sea but does not nest, possibly because beaches are sheltered and have fine sand. Lepidochelys kempi is rare but possibly nests in Cuba. Little effort has been made to record biological data, such as the localization of nesting beaches and the size of nesting populations, as emphasis has been placed on the exploitation of the resource.

Management

There is some strict legislation controlling turtle exploitation in Cuba. Turtles can be killed only for food, not for sport, and cannot be killed at any time on the beaches. Turtles can be caught at sea, however, at all times of year, there being no closed season to protect the nesting period. However, every attempt is made to utilize fully the captured turtles; meat, skin and shell are taken, the bones, carapace and plastron are used in several fishmeal plants, and it is planned that soup-processing factories will use the calipee.

Management programmes administered by the Departamento de Plataforma, of the Instituto Nacional de Pesca (INP), employ simple incubation procedures. Adult turtles caught at sea are released into corrals and may either lay on natural beaches behind the barricades or are slaughtered and the eggs removed from inside for incubation. Natural nests from the beaches are dug up and the eggs replanted in wire-enclosed incubation areas. Hatchlings resulting from these methods are transferred to floating trays, then small ponds, and later to larger ponds where they are fed for up to 1½ months. These young turtles are then released at sea in the hope of sustaining wild populations. Data on hatching and juvenile mortality in these artificial incubation areas were unavailable.

FAO catch statistics for Cuba for 1971 are as follows:

	('000 metric tons)
Chelonia mydas	0.4
Caretta caretta	0.4
Eretmochelys imbricata	0.2

Dominican Republic

No information.

French Territories

French Guiana

Stocks

The largest sea-turtle nesting beach in French Guiana is Silebache, situated between Point Isere, at the mouth of the Maroni River, and the Organabo River. Approximately 15 000 leatherbacks nest on this beach, which is thus the most important nesting ground in the world for this species. Chelonia mydas and Lepidochelys olivacea are both moderately common on this beach and Caretta caretta and Eretmochelys imbricata have been seen occasionally.

Small amounts of nesting occur in the Ile du Cayenne and other areas of the coast.

Management

Sea turtles are protected in French Guiana under legislation passed in 1969. No turtles may be killed or their eggs taken from 1 May to 31 July, a period which encompasses the months of most intensive breeding. During the same period, it is illegal to transport, buy or sell, or expose for sale in markets, any turtle eggs.

There is, however, little attempt at enforcement of this legislation although it is doubtful whether any is required. Turtle meat is rarely eaten in French Guiana being considered a low-status food. The Carib Indians collect leatherback eggs on beaches close to their villages, rarely on Silebache beach, but probably collect only 2 to 4 percent of the eggs laid on any night. It is probably not necessary to restrict this egg harvesting at present.

Guadeloupe and Martinique

No information was obtained from either Guadeloupe or Martinique except that fishermen from the latter island collect green turtles from Aves Island.

Guatemala

There is a hawksbill nesting beach at Cabo Tres Puntas and the sale of turtle meat is forbidden.

Guyana

Stocks

No recent information is available from Guyana. No detailed nesting beach survey has been carried out except for some work on Shell Beach close to the Guyana/Venezuela border. Small numbers of Chelonia mydas, Dermochelys coriacea, Lepidochelys olivacea and Eretmochelys imbricata nest on this beach at slightly different times from March to late August. Sporadic nesting of all four species occurs in several other areas of the coast, such as the Corentyne area, Mahaica - Mahaicony, Tiger Island and the Essequibo beaches.

Management

Following representations made to the Guyana Government on behalf of IUCN, Shell Beach was declared a national monument and the taking of turtles and eggs elsewhere regulated and controlled.

No accurate estimate exists of the rate of exploitation of turtles in Guyana although meat and eggs are marketed in several areas.

Haiti

No recent information.

Honduras

No recent information.

Jamaica

There has been no stock assessment in Jamaica in recent years and no records exist of the present exploitation rate. Port Royal is the main market for turtle products through which green, hawksbill and leatherback meat passes. Eretmochelys and Dermochelys both nest in Jamaica.

Mexico

Stocks

The distribution and size of the turtle populations of the east coast of Mexico are well known. Although there is scattered nesting on most parts of the coast, two areas are of greater importance. The largest Caribbean nesting aggregation occurs on the Islas Mujeres and Cozumel, Quintana Roo in the Yucatan Peninsula, where Chelonia mydas and Caretta caretta occur. A few nesting leatherbacks and Olive Ridleys are reported also from this region. The principal area for the Gulf of Mexico coast is between Barra Ostionales and Barra del Tordo, principally along Barra San Vincente and Barra de la Coma in the state of Tamaulipas. It appears that all the world's population of Lepidochelys kempi nests here so that the protection of this beach is of the greatest international importance.

Management

Following a serious decline in nesting abundance of turtles in all parts of Mexico, a year-long closed season was imposed in 1971 and 1972. New legislation was introduced in 1972 for the better control and maximum sustainable exploitation of turtles and several other commercially important marine species. Exploitation of turtles has been placed exclusively in the hands of the registered cooperative fishing societies. These cooperatives are expected to satisfy certain regulations before obtaining permission to capture turtles, as follows:

(i) Turtles must be exploited primarily for food for human consumption.

(ii) The skin and shell must be used as a side product of the industry.

(iii) The installation must be adequate for handling meat. Only live, whole turtles may be used.

(iv) That turtles are not captured during the period of reproduction and oviposition.

(v) The cooperative assumes responsibility for the campaign to stop the exploitation and consumption of eggs.

(vi) The cooperative establishes turtle hatchery and rearing areas to cultivate and develop the resource in the area where it operates.

(vii) Catch statistics must be recorded and catch must be based on the established quotas for the region concerned. Monthly quotas have been established for the catch of both commercial species, limited to 21 tons, and a closed season of four months - from 1 May to 31 October - to protect the reproductive period. Minimum size limits have also been established to prevent the capture of juveniles. These are for Chelonia (75 cm), and for Caretta (60 cm).

In their management and exploitation of turtles, the cooperatives are responsible to the INP which provides technical advice and trained personnel.

The new legislation applies to all parts of Mexico but, in addition, the INP has conservation projects on the two major nesting areas mentioned above. In the Isla Mujeres region of the Caribbean coast, there is a special programme to protect both Chelonia mydas and Caretta caretta. This is effected by patrolling beaches to stop the killing of nesting females and the taking of their eggs. Some captive-culture of juveniles is carried out. Processing plants in the Yucatan Peninsula export large quantities of frozen green turtle and small quantities of loggerhead meat to the U.S.A.

On the Gulf of Mexico, turtle camps are established at Rancho Nuevo each year to give complete protection during the Ridley nesting season. The camps are staffed by INP staff with assistance from the military. These provide protection to the nesting females, collect eggs for incubation in special preserves, and collect and nurture hatchlings for later release. There is also a programme of tagging and collection of morphometric data.

Data on the rate of exploitation in Mexico in recent years are not available.

Netherlands Dependencies

Surinam

Stocks

Sea-turtle nesting takes place mainly in two areas of Surinam. These are the Galibi area (Eilanti and Baboensanti), near the mouth of the Marowijne River, and the Bigisanti Beach, further to the west.

The Surinam Forest Service (Lands Bosbeheer) and biologists from University of Florida, have carried out considerable research into the nesting biology of sea turtles over many years so that a great deal of information is available. The approximate numbers of the five species which depend on Surinam beaches for reproduction are as follows:

Chelonia mydas	between 3 700 and 4 800 females
Lepidochelys olivacea	about 2 000 females
Dermochelys coriacea	about 300-400 females
Eretmochelys imbricata	about 10 females
Caretta caretta	about 1 female/5 years

It is known from a large number of tag returns that many green turtles which nest in Surinam come from the south Atlantic from feeding grounds off the Brazilian coast. These feeding grounds are not well documented. It is probable that the leatherbacks nesting in Surinam are a spill-over of the French Guiana nesting populations.

Management

At present, the Game Ordinance (1954) and the Game Decree (amended in 1954) are in force and prohibit completely the killing of marine turtles. The collecting of eggs is permitted from 1 May to 1 September.

The Bigisanti rookery is located in the Wia-Wia Nature Reserve (created in 1961). It is expected that, because the beach is moving westward, legislation will be introduced to protect nests laid outside the present reserve.

The Galibi nesting grounds were declared a nature reserve in 1969. Management of the nature reserves is in the hands of the Forest Service, under the Minister of Mines, Forests and Lands. General management and patrolling is carried out by the Nature Preservation Section of the Forest Service, which section permanently patrols the Bigisanti and Galibi rookeries. Police officers and forest guards of other sections of the Forest Service assist. Management programmes include replanting of eggs and protection of nests against crabs and collection of biological data.

Killing of adult turtles ceased completely since 1964. Because of constant surveillance, no illegal exploitation of turtles takes place on the nesting beaches. It is thought, however, that large numbers are caught in territorial waters by American and Japanese shrimp trawlers. The effectiveness of the Surinam turtle management programme is jeopardized by the apparently unregulated exploitation in Brazil of female turtles which nest in Surinam. Brazilian annual turtle catch statistics are urgently required.

Carib Indians have collected eggs in the Surinam nesting areas for many years. It is the intention of the Forest Service to exploit turtle eggs as a source of protein on a sustained yield basis. The formula to be used in calculating the annual proportion of eggs which can be harvested is not yet available but the Indians have been allowed to collect the following numbers in the Galibi sanctuary:

	Year	Collected	Approximate total laid
Chelonia mydas	1970	150 000	350 000
	1971	200 000	790 000
	1972	200 000	880 000
	1973	300 000	920 000

The majority of eggs collected were from nests threatened by destruction by beach erosion and were too far from the hatchery.

Lepidochelys olivacea 1970 (30 000 of a total of about 200 000). No Ridley eggs have been collected since 1971 and collecting eggs of the other species is prohibited.

Some 23 525 green-turtle eggs (of which 16 418 hatched) were sold to Mariculture Limited in Grand Cayman Island in 1970, together with eight adult females. In 1972 and 1973 a total of 120 000 more eggs were sold to the same pilot turtle farm. It is expected that 250 young turtles will be returned to Surinam and the adults will be returned in 1976. An attempt will be made to rear all these in tanks in Surinam.

Curaçao

No survey of stocks or exploitation of turtles has been carried out although there is probably little, if any, nesting on the island.

Bonaire

Local Government legislation of June 1961 prohibits the taking and selling of turtles and turtle eggs. This is enforced by the civil police. No estimate is available of the turtle stocks.

Aruba, St. Maarten, St. Eustatius, Saba

No information available other than old records of leatherback nesting in St. Maarten.

Nicaragua

Stocks

No census of the Caribbean nesting populations in Nicaragua has been undertaken in recent years but scattered nesting of green and hawksbills occurs as well as some leatherbacks nesting in the south. Green turtles which nest in Costa Rica feed in Nicaraguan waters but the once vast feeding aggregations are now reduced to scattered refuge populations.

Management

In 1965 the Nicaraguan Government imposed a two-month closed season, from 15 May to 15 July, on the east coast. However, there has been considerable difficulty in enforcing this regulation and a survey conducted in 1971 of the cays off the east coast indicated that 95 percent of the eggs were collected and between 50-60 percent of the females killed.

Nicaragua did not ratify the tripartite agreement on controlled turtle exploitation formulated at the meeting with Costa Rica and Panama in 1969 and this proposed international agreement dissolved. Following this meeting, Cayman Island turtle boats were barred from the Miskito Banks but Nicaraguan turtlers worked with increased intensity.

Late in 1969 a foreign-owned turtle-meat-packing company was established at Bluefields and a second one the following year in Puerto Cabezas. These companies buy from 4 000 to 5 000 green turtles each year for export and consequently, the number of turtles caught and sold by the Miskito Indians has increased considerably. Previously, the hawksbill turtle was considered of inferior meat value and the loggerhead was not taken but fishing for these two species for shell and skin respectively is now carried out extensively. Local Indian populations are becoming increasingly dependent on diminishing supplies of the threatened green turtle.

Panama

Stocks

The Caribbean coast of Panama has extensive feeding grounds used by green turtles which nest in Costa Rica. The size of these feeding populations is not known but is thought to be much smaller than previously.

Chiriqui Point and the San Blas Islands were once major western Caribbean nesting areas for the hawksbill turtle but both are now sadly depleted. There is sparse leatherback nesting on beaches in the south.

Management

In 1969, Panama signed an agreement with Costa Rica to regulate turtle exploitation but, following on the failure of Nicaragua to ratify this agreement, it was dissolved. At the present time, unregulated exploitation continues on the Caribbean coast.

Trinidad and Tobago

Stocks

Small numbers of turtles nest on the north and east coast of Trinidad. Dermochelys coriacea, Chelonia mydas, Eretmochelys imbricata, Lepidochelys olivacea and Caretta caretta have been recorded in the island and the first three also nest in Tobago.

The leatherback is the most common species, the total nesting population containing from 400 to 500 mature females. No population estimates are available for the other species.

Management

The Government of Trinidad and Tobago has no active programme of research or management of sea turtles. Stock assessment and conservation studies form part of the research programme of the University of the West Indies.

At the present time, turtle protection regulations produced in 1952 are in force. These prohibit the killing of turtles, removal of eggs, and sale of meat and eggs only from 1 June to 30 September in any year. They are, therefore, very unsatisfactory as the sea turtles are not protected during April and May when most nesting occurs. Furthermore, there is no enforcement of these regulations.

No accurate exploitation data are available. Most nesting turtles seen on beaches are killed and meat and eggs utilized. The annual catch of turtles at sea, mostly greens and hawksbills, is probably in excess of 50 000 lb.

Various conservation measures have been recommended to Government, including an extension of the closed season to cover the main nesting period and the establishment of one north coast and one east coast beach sanctuary area, and these are at present under consideration.

During the 1973 nesting season the Society for Prevention of Cruelty to Animals in Tobago offered rewards of T.T.$ 50 to persons ensuring that nesting turtles returned safely to the sea. Rewards were increased to T.T.$ 75 in 1974. Many turtles were protected in this way.

United Sates of America

Stocks

At the present time, no accurate marine turtle census of the U.S. coastline exists and detailed, long-term studies of the major rookeries have not been undertaken. Research of the federal level has generally only been conducted by Bureau of Sport Fisheries and Wildlife personnel on National Wildlife Refuges. These studies have generally been limited to annual nest counts, predator control programmes, etc., although more detailed studies from Cape Romain were published many years ago. State research has been almost non-existent, the only major study being on Hutchinson Island, Florida. The only long-term population studies have mostly been privately financed.

Management

In the United States, sea turtles receive varying degrees of protection under both state and federal regulation.

At the federal level, responsibility is limited to those species listed on the U.S. endangered species list as foreign species. Under the provisions of the law, species so listed may not be imported into the United States without a federal permit. Permits are issued only for scientific purposes. At the present time, the hawksbill (Eretmochelys imbricata), leatherback (Dermochelys coriacea), and Atlantic Ridley (Lepidochelys kempi), are on this foreign list.

At the state level, most regulations have been promulgated by the coastal states having exploitable turtle resources. These enactments are quoted below:

- North Carolina

The only protection is a law passed by the General Assembly which prohibits the taking of marine turtles or their eggs from 1 May to 1 September.

- South Carolina

The state code makes it unlawful for any person to kill or offer for sale any sea turtle, or to offer for sale, sell, or destroy any turtle eggs.

- Georgia

Protected by state hunting regulations, sea turtles and their eggs are considered totally protected species of wildlife and may not be taken at any time.

- Florida

It is a misdemeanor to take, possess, disturb, mutilate, destory, cause to be destroyed, sell, offer for sale, transfer, molest, or harass any marine turtle nest or eggs at any time.

It is unlawful for any person to take, kill, possess, mutilate, or in any way destroy any loggerhead, leatherback, trunkback, hawksbill, green or Ridley, or take or possess any part thereof while such turtle is on the beaches, sand dunes, or territorial waters of the east coast of Florida (Georgia-Florida line, southward through Dade County) during the months of May, June, July and August.

It is unlawful for any person to take, kill, possess, mutilate, or in any way destroy any turtle, or take any part thereof, while such turtle is on the beaches or sand dunes of the west coast of Florida between the boundary between Monroe and Collier Counties and the western boundary of the state, excepting those turtles in the territorial waters thereof having a carapace measurement of more than 26 inches (curve-of-shell).

It is unlawful for any person to take, kill, possess, mutilate, or in any way destroy any green turtle, or take or possess any part thereof, while such turtle is on the beaches, sand dunes, or territorial waters of Monroe County unless such turtle has a carapace measurement of more than 41 inches (curve-of-shell), unless such person has a certified invoice that said turtle was shipped into Monroe County from a foreign country or outside the territorial waters of the state.

The Department of Natural Resources was also authorized to establish controlled nesting reserves free from all predators and, after 1 January 1971, they could establish minimum sizes of turtles which could be taken. To date no changes have been made.

Legislation has been introduced in the 1973 session which would, among other things, relax the restrictions on the west coast.

- Texas

It is unlawful for any person to knowingly take, kill, or disturb any sea turtle or any sea-turtle eggs in or from the waters of the state of Texas. The penalty for violation of this is a fine of not less than U.S.$ 10 nor more than U.S.$ 200.

It is also illegal to ship any green turtle of less than 12 lb in weight.

In May 1974 a female Lepidochelys kempi nested on Padre Island. It was possibly from a batch of hatchlings released there in 1966 in an attempt to restock this part of the animal's natural range from which it had been absent for many years as a result of human predation.

Among those states having few (if any) marine turtles within their boundaries, the following have protective legislation:

- Maryland

In November of 1972, the state endangered species list was amended to include the Atlantic green turtle (Chelonia mydas mydas), loggerhead (Caretta caretta caretta), Atlantic hawksbill (Eretmochelys imbricata imbricata), and Atlantic leatherback (Dermochelys coriacea coriacea). Species on the state list may not be collected or sold without a special permit, issued only for research intended to contribute to the survival of the species.

- New York

The state prohibits the importation, transportation, possession, or sale of endangered species. They currently list the hawksbill (Eretmochelys imbricata), leatherback (Dermochelys coriacea), and Atlantic Ridley (Lepidochelys kempi). In September 1973, the state banned the sale of "tortoise shell", as hawksbill shell is known commercially by jewellery stores.

- Illinois

As of 1 January 1973, the importation, sale or possession of dead or live, intact, or skinned and beheaded species on the state endangered species list, is illegal. This list includes all species on the federal list (hawksbill, leatherback, and Atlantic Ridley), as well as the green turtle and the Olive Ridley.

At the federal level, enforcement of the Endangered Species Act becomes a matter for game management agents at the U.S. ports of entry. Control of sea-turtle products has been good and is getting better but remains hampered by the difficulty of identifying some processed materials. At the present time, the U.S. Fish and Wildlife Service is preparing keys and materials to aid enforcement personnel as well as updating the foreign status reports.

Puerto Rico

Stocks and exploitation

The last major inventory of the turtle stocks of Puerto Rico was taken in 1900, since which time there have been no regular nesting records kept. Dermochelys and Eretmochelys both nest in the island and Chelonia mydas and Lepidochelys olivacea occur in coastal waters. About 200 adult loggerheads are caught each year but this species is not known to nest there.

Market statistics show that from 1968 to 1973 about 20 000 lb of turtle meat was sold each year. There is a large trade in juvenile hawksbill shells and much of the supply of green-turtle meat on the market probably comes from St. Lucia.

Management

The island's turtles come under the U.S. Endangered Species Act. In addition, a regulation dated 1948 of the fisheries law prohibits the taking of turtles on the beaches and the taking of turtle eggs.

U.S. Virgin Islands

The leatherback and hawksbill are known to nest in St. Croix and possibly the other U.S. Virgin Islands. No detailed information on nesting beaches, size of nesting populations or rate of exploitation are available.

Sea turtles are protected by the federal Endangered Species Act as far as capture in U.S. waters and import of turtle products into the various states are concerned. In addition to this, the Virgin Islands Fisheries Act was signed into law on November 1972. For the first time, extensive protection has been given to the local fishing industry and to many of the natural marine resources.

All marine turtles and their eggs are protected. No turtles may be captured or kept on shore or land. Turtles may not be captured in the water during the months of May to September inclusive. Nests and eggs may not be disturbed, taken, possessed, or sold at any time.

The Department of Commerce is charged with promoting and developing the local commercial fishing industry and the Department of Conservation and Cultural Affairs is responsible for the enforcement of the new regulatory and conservation measures.

Venezuela

Stocks

There have been no detailed investigations into the existing stocks of either the commercially important green turtle (Chelonia mydas), or other species in Venezuela. It is known, however, that Dermochelys coriacea, Eretmochelys imbricata, Lepidochelys kempi and Caretta caretta occur in coastal waters and probably nest there in small numbers. Nesting beaches have not been documented.

Management

There are no specific legal provisions governing the marine-turtle fishery and, so far, no particular action has been taken by the Venezuelan Government to protect this resource.

Recent turtle catch statistics are as follows:

	(in kg)		
	1969	1970	1971
Green turtle	43 342	42 909	13 691
Other species	4 208	3 364	11 092

Aves Island

Aves Island contains the second largest green-turtle rookery in the Caribbean area and the most important area for the eastern Caribbean.

Accurate records of the population size and exploitation rate are unavailable although several investigators have noted the decline in turtle numbers over the last few years due to intense exploitation by fishermen from the Lesser Antillean islands.

The Government of Venezuela declared the island and surrounding waters a faunal preserve in August 1972.

Investigations of the Aves Island green-turtle populations are being carried out by the Caribbean Conservation Association.

Other Offshore Islands

No information is available on turtle stocks and exploitation on La Tortuga, Margarita and other offshore Venezuelan islands, except Los Roques where green, hawksbill and a few loggerheads have been recorded.

INSTITUTIONS AND CONSERVATION AGENCIES INVOLVED IN SEA-TURTLE RESEARCH IN THE CARIBBEAN REGION

Several North American universities, such as the University of Florida, have been involved in turtle research in the Caribbean region for many years and have made important contributions to our understanding of turtle biology and conservation. On the national level, many projects have been carried out on a smaller scale by government fishery units, universities and amateur individuals and societies. These have contributed significantly to sea-turtle research but their results are not generally available.

A number of international societies and agencies are involved with turtle conservation work in the regions. The Caribbean Conservation Corporation sponsored early studies of green turtles at Tortuguero, Costa Rica, and took part in the hatching-restocking programme arising in the same area. This body also started a pilot turtle ranch in the Bahamas.

The Caribbean Conservation Association has made an inventory of eastern Caribbean turtle information but this is not generally available and, with the Islands Resources Foundation, sponsored a survey of certain turtle nesting areas in the south and western Caribbean during 1972. Over the 1971 and 1972 nesting seasons, the Association promoted nesting surveys on Aves Island and was instrumental in encouraging the Venezuelan Government to have this island fully protected. Results of all these surveys are not yet published. A proposal was submitted to IUCN on behalf of CCA for a Caribbean sea-turtle resource survey when the CICAR group had previously agreed to conduct a similar survey. The Institute of Marine Sciences, University of Miami, Florida, is also engaged in a survey of the Gulf and Caribbean turtle fishery. Such duplication of effort is unfortunate and should be avoided.

A few countries in the region are represented on the Marine Turtle Specialists Group, Survival Service Commission of IUCN. These are the U.S.A., Colombia, Mexico, Surinam and Trinidad and Tobago. This Group met in Switzerland in 1969 and 1971 to review the world turtle situation to establish research priorities and to formulate an action programme for effective conservation and management of the declining sea-turtle populations. All their recommendations are appropriate to the Caribbean region. Liaison between the IUCN and the independent territories of the region is variable and there is need to improve communication between the Turtle Specialists Group and turtle biologists in the field.

Proposals were made in 1972 to IUCN for the establishment of a turtle data centre but this has not yet materialized. The University of Florida, Gainsville, which initiated tagging programmes in the Caribbean, at present acts as a clearing house for all local tag information.

FAO is active in the field of turtle research also. This organization attemps to colate turtle fishery statistics from the Caribbean and adjacent regions but, due to the difficulty of obtaining records from local fisheries departments, the most recently published statistics in the 1971 Fisheries Yearbook are so incomplete that they are of little value. The FAO/UNDP (SF) Central American Regional Fisheries Development Project cooperated in and facilitated the tripartite meeting on green-turtle conservation in Costa Rica in 1969 between Costa Rica, Nicaragua and Panama. FAO is still attempting to get the agreement drawn up at this meeting ratified by all parties and is encouraging other governments to join. FAO and IUCN are publishing species synopses on marine turtles and there is the possibility of a joint project to produce a field manual on turtles dealing with identification, biology and conservation practices.

DISCUSSION

It is apparent from the above survey of turtle stocks in the Caribbean countries that there is need for greater dissemination of information and for coordination of the management programmes.

Accurate, detailed statistics for the size of the nesting, feeding, or resident turtle populations in many countries could not be presented in this report. In some cases, this was because the statistics are to be found only in local bulletins or government office records and were not obtained by the author. In many countries, with significant turtle resources, such as Brazil, Venezuela, U.S.A. and the islands of the eastern Caribbean, scientific surveys have not been conducted in recent years. Basic stock-size data are essential for any regional conservation programme and steps should be taken, therefore, to have the necessary surveys conducted and the data collected made available to turtle specialists in the Caribbean region.

The present uncontrolled turtle fishing in international waters of the Caribbean and adjacent regions is capable of negating national conservation measures. This is particularly true of the highly localized rookeries of Lepidochelys kempi in Mexico and Chelonia mydas in Costa Rica and Aves Island which supply distant feeding grounds. Legislation, such as the U.S. Endangered Species Act, which limits imports of turtle products, and the Mexican catch-quota system have some effect on this fishery but there is need for a survey of the exploitation rate in international Caribbean waters and the institution of some regional control system.

Historically, each country has developed its own turtle exploitation/management plan in isolation. Consequently, there is a wide variety of conservation practices current in the region. For example, Costa Rica protects the nesting beach at Tortuguero to allow natural incubation of the eggs but has no closed season for the taking of adults. Artificial hatcheries were in use for some years and attempts were made to restock depleted beaches in other countries but these practices have been discontinued. In contrast, Cuba enforces minimum size limits to protect juveniles at sea but has no closed season. Eggs from natural nests and from slaughtered females are incubated and the young reared under artificial conditions as they are in Surinam but not in Mexico. Mexico prohibits the utilization of turtle eggs, whereas Surinam allows a large percentage to be taken but prohibits the killing of the adults.

Many turtle specialists would argue that exploitation and management practices must be geared to local social and economic conditions but the problem is complicated by the movement of turtles across international boundaries. Costa Rica has already appreciated the necessity for international regulation of turtle exploitation and is seeking agreement with Nicaragua and Panama on a common conservation programme. The Surinam programme is being affected by unregulated exploitation in Brazilian waters and the decimation of the Aves Island green-turtle rookery by eastern Caribbean fishermen is receiving attention from the Venezuelan Government. In these, and other cases, some international agreement on turtle exploitation has become an urgent necessity.

It is difficult to imagine, furthermore, that all the present management practices are equally effective in resuscitating depleted turtle populations and maintaining the maximum sustainable yield. The area countries should seek to establish, therefore, which are the most effective, generally acceptable methods for use in turtle conservation and arrange to have national programmes organized on this basis. The recommendations of the Marine Turtle Specialists Group, IUCN, at their 1969 and 1971 meetings could be used as a guide in these discussions (IUCN, 1969-71). They stressed the importance of the natural nesting beaches by recommending the setting up of totally controlled refuge situations for turtles and allowing eggs to develop in natural nests. The group agreed that turtle protection and restoration programmes should concentrate on allowing the young turtles to follow as natural a life cycle as possible; thus, eggs should only be transplanted to hatcheries when absolutely necessary and hatchlings from hatcheries should be allowed to run down the beach into the sea. Also hatchlings should not be transported to distant beaches for release, nor should they be kept in "holding tanks" for prolonged periods.

Further recommendations included the promotion of local legislation prohibiting the taking of eggs or nesting female turtles on any island or mainland shore and the organization of strict local and international control over the trade in calipee and turtle skins. This control should prohibit the exportation or storage of either product during the peak nesting period and ensure that neither product could enter the market when taken from a turtle not otherwise used.

The IUCN Group stressed also the importance of the captive culture of adult turtles, especially Chelonia mydas, as a means of reducing pressure on wild populations. However, considerable research into cultivation techniques is required and care should be taken when establishing a turtle farm not to deplete natural nests to provide young turtles. Pilot turtle farms should be established by government agencies in as many Caribbean countries as possible and controls should be set up to stop turtle farms attempting premature commercial operations.

The emphasis in regional turtle research has been on the controlled exploitation and protection of large turtle populations, e.g., Dermochelys in the Guianas, Chelonia mydas in Cósta Rica and Aves Island, and Lepidochelys kempi in Mexico. However, in the major part of the region, there exist very small numbers of nesting turtles which represent the remnants of formerly important populations decimated by exploitation pressures on land and at sea. This is particularly true of the eastern Caribbean islands but also of large areas of the mainland coasts which today have very small, commercially unimportant nesting populations. The nine-year experiment conducted from Costa Rica, for restocking exhausted nesting grounds by transporting eggs or hatchling turtles from still-used nesting beaches, has not yet yielded positive results. It would be appropriate, therefore, to reinvestigate the possibility of introducing new methods for boosting small turtle populations.

In view of the increasing body of data and workers in the field of turtle research, there is need to establish clear channels of communication between the field scientist or fisheries officer and the international conservation agencies. This would serve also to reduce the duplication of effort which exists at present and the promotion of management techniques in one country which have been discontinued in other countries. This could be accomplished by the formation of a Caribbean turtle specialists committee, fully representative for the region and closely associated with IUCN, FAO, CCA, University of Florida, and other interested organizations which would seek to coordinate management programmes in the region. The headquarters of this group should act as a data centre. It is important, however, that such a centre should act, not only for the collection of sea-turtle information, but for its immediate dissemination throughout the region. The specialist committee would be in a position to promote international legislation to control exploitation rates and to ensure the equitable distribution of the profits resulting from national conservation efforts.

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Personal Communication

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